Sept. 11, 1956 J. M. KING ET AL 2,762,304

DELAY ARMING FUZE FOR PROJECTILES

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Fig. 1.

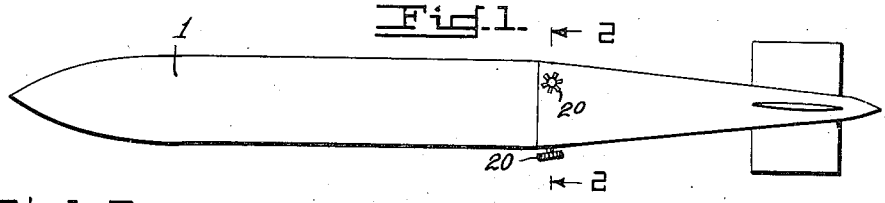


Fig. 2.

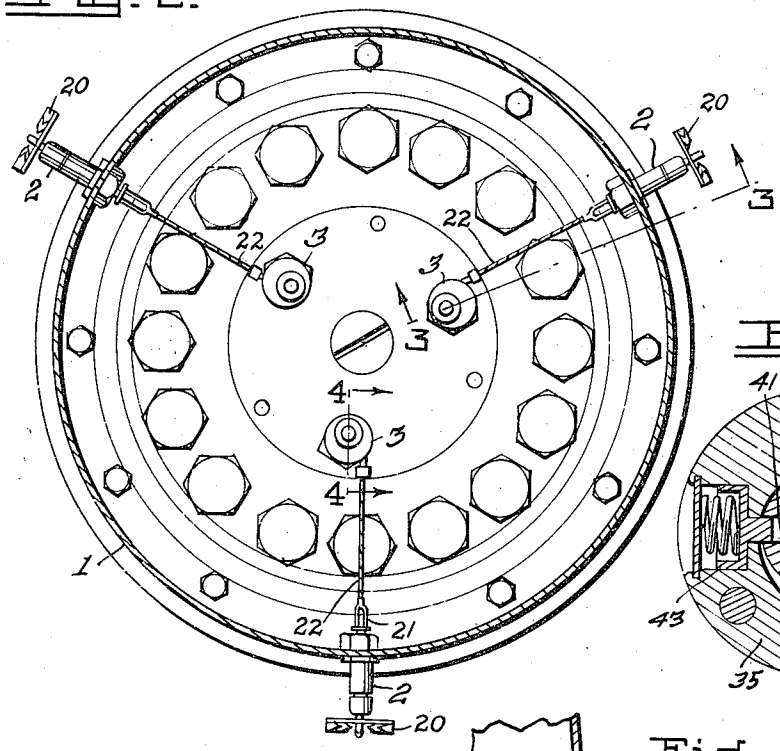


Fig. 10.

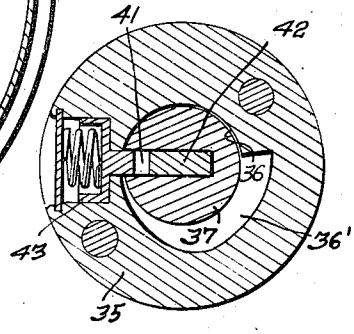
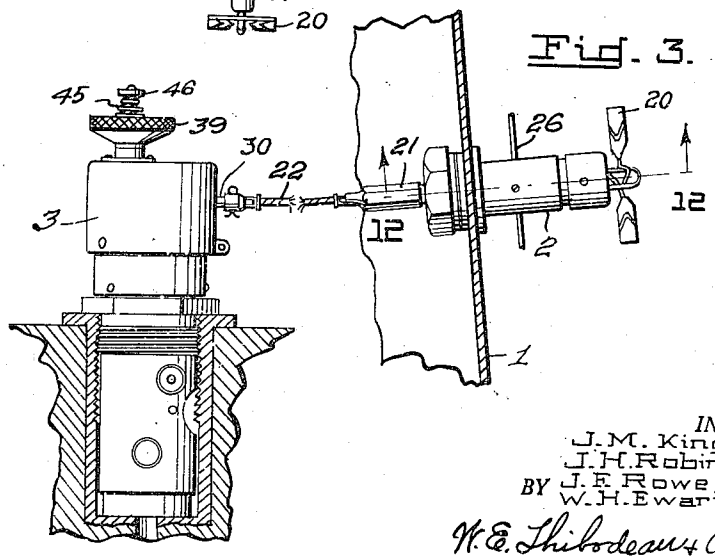


Fig. 3.



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Fig. 4.

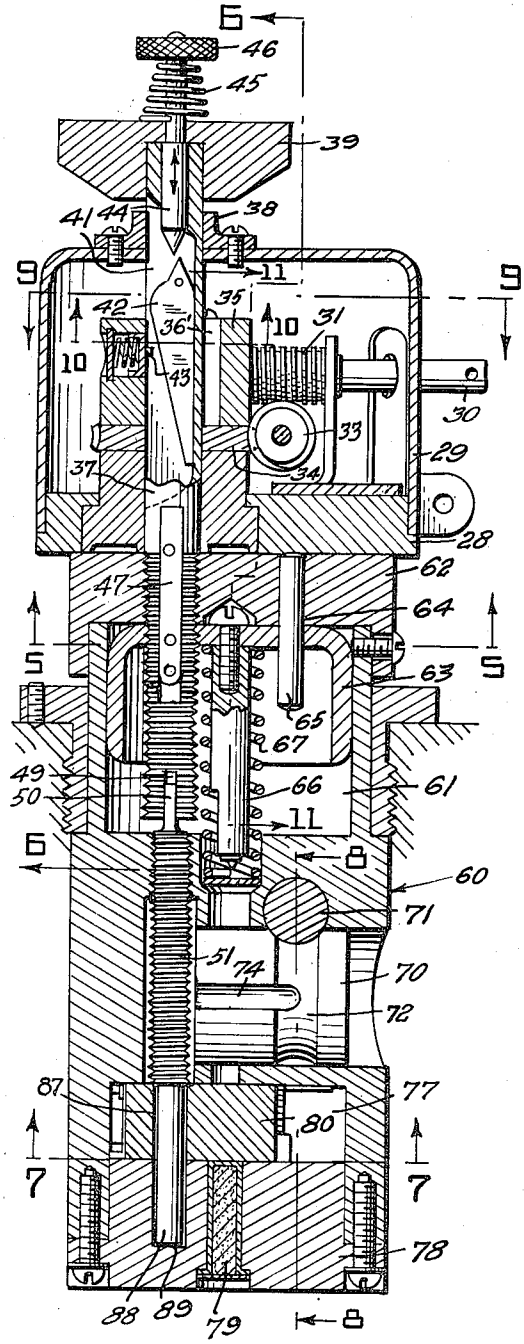


Fig. 5.

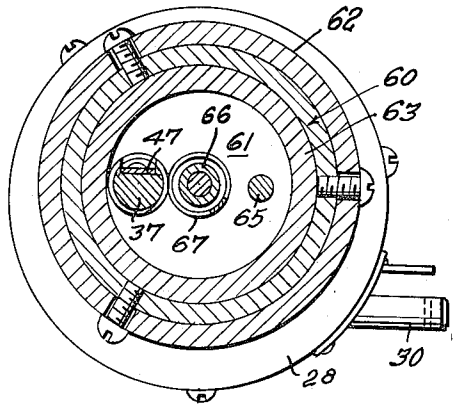
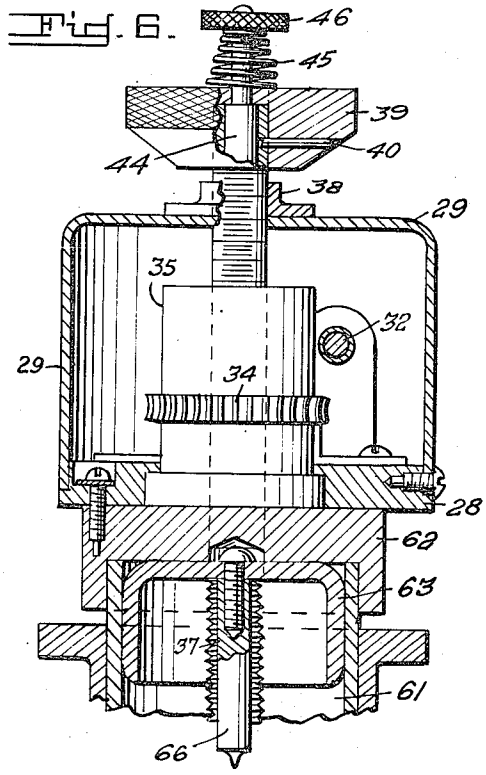


Fig. 6.



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Fig. 7.

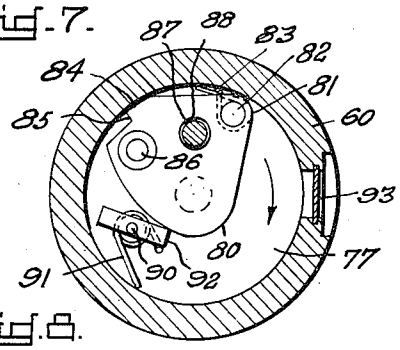


Fig. 8.

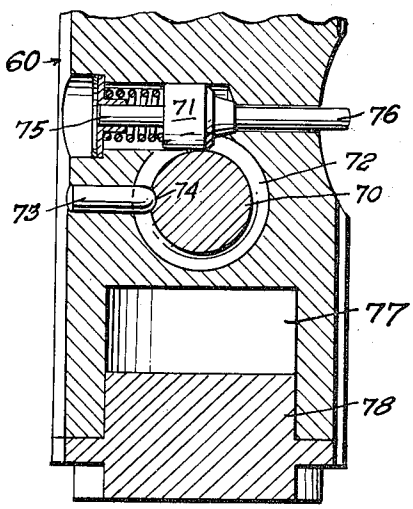


Fig. 9.

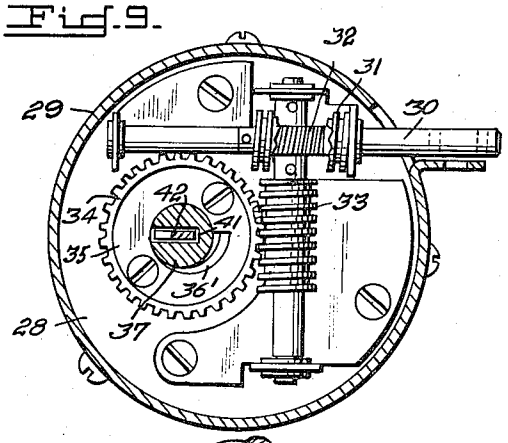


Fig. 11.

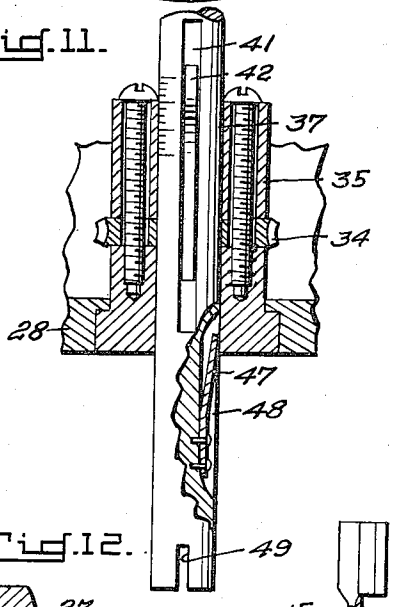


Fig. 12.

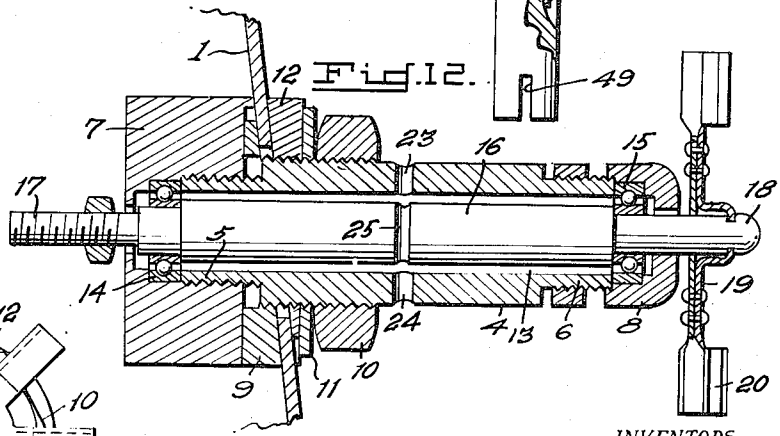
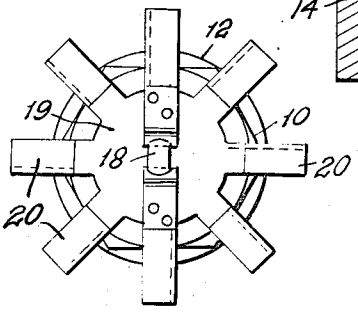


Fig. 13.



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2,762,304

DELAY ARMING FUZE FOR PROJECTILES

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Application June 10, 1953, Serial No. 360,852

4 Claims. (Cl. 102—81.2)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty thereon.

This invention relates to an improved delay arming fuze for projectiles, and more particularly to a fuze for aircraft bombs or missiles.

It is a primary object of this invention to provide a fuze for aircraft bombs or missiles which will remain in a safe or disarmed condition during the initial stage of its flight and which will arm only after the missile-fuze combination have traveled a sufficient distance so that detonation of the fuze will not endanger the crew.

Another object of the invention is the provision of an arming vane assembly separate and apart from the fuze body assembly but connected thereto by a rotatable flexible shaft.

A further object of the invention is to provide the fuze with a novel variable arming means which permits presetting and resetting of the fuze.

Still a further aim of the invention is to provide a fuze in which a detonator of an interrupted explosive train is carried by a rotor assembly which is held in unarmed position by an extension of the arming stem assembly which also holds the firing pin assembly in unarmed position. The rotor assembly is arranged so that when moved into armed position it will not be counter-rotated due to shocks arising from impact.

Other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, which illustrates preferred embodiments thereof and wherein:

Figure 1 is a view in elevation of an aircraft missile provided with several of the fuzes according to the invention.

Figure 2 is a cross sectional view to an enlarged scale of the aircraft missile taken along the line 2—2 of Figure 1.

Figure 3 is a sectional view taken along the line 3—3 of Figure 2 showing the relative positions of the arming vane assembly and the fuze body assembly.

Figure 4 is a longitudinal, substantially central sectional view of the improved fuze body, showing the parts in the safe or unarmed position.

Figure 5 is a cross sectional view taken along the line 5—5 of Figure 4.

Figure 6 is a fragmentary sectional view taken substantially along the line 6—6 of Figure 4.

Figure 7 is a cross sectional view taken along the line 7—7 of Figure 4.

Figure 8 is a fragmentary sectional view taken substantially along the line 8—8 of Figure 4.

Figure 9 is a cross sectional view taken along the line 9—9 of Figure 4.

Figure 10 is a cross sectional view of the gear lock assembly taken along the line 10—10 of Figure 4.

Figure 11 is a fragmentary sectional view taken substantially along the line 11—11 of Figure 4.

Figure 12 is a longitudinal sectional view of the arming vane assembly taken substantially along the line 12—12 of Figure 3.

Figure 13 is a front elevational view of the arming vane assembly.

Referring more particularly to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in Figure 1 an aircraft bomb 1, in the conical tail of which are positioned several fuzes of like structure.

The fuze consists of separate main assemblies, the arming vane assembly 2 and the fuze body assembly 3. The two assemblies are positioned so that the longitudinal axis of the arming vane assembly is substantially normal to the longitudinal axis of the fuze body, as is best seen in Figures 2 and 3.

The arming vane assembly 2, best shown in Fig. 12, includes a cylindrical housing 4 having reduced externally threaded inner and outer end portions 5 and 6. The inner end portion 5 extends into the inner part of the tail bomb. A large nut 7 is threaded on the inner end portion of the housing and an apertured cap 8 is threaded on the outer end portion. The cylindrical housing 4 is secured in its outwardly extending position by the nut 7 which presses a wedge 9 against the inside surface of the bomb tail, and by a second nut 10 threaded on the housing 4 which presses a washer 11 and a second wedge 12 against the outside surface of the bomb tail. Positioned in the bore 13 of the cylindrical housing and supported by the shaft bearings 14 and 15 is a rigid shaft 16 having inner and outer ends 17 and 18 of reduced diameter, which extend beyond the large nut 7 and the cap 8, respectively. On the outer end 18 of the rigid shaft is an arming vane 19 having V-shaped blades 20. The inner end 17 of the shaft is threaded to receive a coupling 21, shown in Fig. 3, which secures one end of a flexible metal shaft 22 to the rigid shaft 16. Opposed openings 23 and 24 in the cylindrical housing register with a transverse opening 25 in the shaft 16, in one position of the shaft, for receiving an arming wire 26 (see Figure 3) to hold the shaft against rotatory movement With the arming wire removed movement of the bomb through the air causes the arming vane to rotate. This rotation is transmitted through the rigid shaft 16 to the flexible shaft 22, and in turn to the gear shaft 30 of the reduction gear mechanism of the fuze body assembly 3, as is best seen in Figure 9.

The reduction gear mechanism is supported by a base member 28 and inclosed by a cup-shaped cover 29. Rotation of the gear shaft 30 causes worm 31 to drive worm gear 32 and worm 33, which in turn meshes with ring gear 34 to cause that gear to rotate. Ring gear 34 is fixedly mounted on the tubular gear lock housing 35 and causes it to rotate at the same speed. The gear lock housing is rotatably mounted in the base member 28 and is formed with a bore 36 having an offset 36'. Bore 36 forms a bearing for the upper arming stem 37 which is rotatably disposed therein and which passes through index collar 38 on cover 29. The end of the arming stem 37 extending above the cover has a knurled setting knob 39 fixed thereto by means of a pin 40. Between the knob 39 and the gear lock housing 35 the arming stem 37 is calibrated in thousands of feet. Immediately below the knob is a keyway 41 in which there is a pivoted cam 42. Adjacent the cam is a spring loaded gear lock detent 43 mounted in the gear lock housing 35 so as to extend into the bore 36 radially thereof for engagement in the keyway 41, to cause the arming stem and gear lock housing to rotate as a unit. Projecting into the keyway and extending above the knob 39 is a reciprocally movable plunger 44 which is held in an inoperative position by a volute spring 45 bearing against the knob 39

and a plunger cap 46 secured to the top of the plunger 44. A shaft lock spring 47 is contained in a recess 48 in the lower half of the upper arming stem 37, the purpose of which will hereinafter be set forth. The lower end of the arming stem is slotted at 49 so as to receive the flat sided tongue 50 on the upper end of the lower arming stem 51.

The housing for the firing pin and explosive train is designated generally as 60. The upper portion of the housing is provided with an upwardly opening chamber 61 which is closed by a cover 62 secured to the base member 28 by bolts, as is best seen in Figure 6. The threaded portion of the upper arming stem 37 passes through and is in threaded engagement with the cover 62 and also with a cup shaped plunger 63 which is thereby positively held in the safe position in the chamber. The plunger is provided with an aperture 64 for receiving a downwardly extending guide pin 65 fixed in the cover. A firing pin 66 is secured to the center of the plunger 63 and is in line with the explosive train when the fuze is armed. A helical creep spring 67 surrounds the firing pin and holds it in a safe position in the absence of the arming stem 37 until impact.

Mounted in a cylindrical recess in the side of the housing 60 is a cartridge type delay element 70 which also contains a relay charge (not shown). The delay element 70 is locked in position by a spring pressed latch 71 which engages a peripheral groove 72 in the delay element. A pin 73 engages a longitudinal groove 74 in the delay element to properly seat the element. The two ends 75 and 76 of the latch 71 are of such length as to prevent seating of the fuze body assembly 3 into the bomb cavity unless the delay element 70 is present in the fuze body assembly and properly positioned therein.

Below the delay element 70 the housing 60 is provided with a downwardly opening chamber 77 which is closed by a plug 78 containing the tetryl lead 79. Within the chamber 77, as seen in Fig. 7, is a rotor 80 of substantially triangular shape having an extremity 81 provided with a pivot pin 82 surrounded by a spring 83 which urges the rotor to an armed position. Another extremity 84 is provided with a shoulder 85 adjacent which is a detonator 86. Between the two extremities and in line therewith is an aperture 87 designed to receive the lower end 88 of the lower arming stem 51, which rotates in unison with the upper arming stem 37 and is mounted in the housing 60 immediately beneath the chamber 61. The portion 88 of the lower arming stem which passes through the rotor and engages the recess 89 in the plug 78 is not threaded and presents a smooth surface. When thus engaged the rotor is held in the unarmed position with its detonator out of line with the explosive train of the delay element 70 and the relay charge therein. As seen in Fig. 7 a pin 90 serves as a guide for the torsion spring 91 which presses a rotor lock bar 92 against the rotor. When the rotor is in the armed position the shoulder is engaged by the rotor lock bar to oppose any counterrotation of the rotor. A window 93 is situated in the wall of the chamber to readily determine if the rotor is in an armed or unarmed position.

To set the fuze the spring biased plunger 44 on top of the setting knob 39 is depressed. When depressed the end of the plunger strikes the pivoted cam 42 which pivots and forces the spring loaded gear lock detent 43 out of the keyway 41 to allow the arming stems 37 and 51 to be rotated independently of the gear lock housing 35. One revolution of the arming stem changes the air travel arming of the fuze by 1,000 feet. The proper air travel setting, is obtained by aligning the air travel desired (calibrated on the upper arming stem) with a prescribed line on the index collar 38.

Two safety features are provided within the upper arming stem to prevent a setting of less than 5,000 feet. One feature is the length of the cam 42. When a setting of

5,000 feet is reached the spring pressed gear lock detent 43 reenters the keyway as the cam is of such length as to no longer engage the detent. When such an event occurs the arming stem is able to rotate only when the gear lock housing rotates and the lower arming stem 51 still holds the rotor 80 is an unarmed position. A second safety feature is the spring shaft lock 47 which enters the gear lock housing bore offset 36' when the setting reaches under 5,000 feet. This event causes the arming stem 37 to become locked to the gear lock housing 35 with the result described above.

Once the desired setting is obtained the bomb 1 is ready for launching. When a bomb containing the fuze is launched, rotation of the arming vane 20 turns the arming vane shaft 16, the flexible shaft 22 and the reduction gear mechanism to cause rotation of the arming stems 37 and 51 which causes them to be unscrewed out of the fuze body. The number of revolutions of the vane required to arm the fuze body is determined by the arming setting. After the required air travel has been accomplished, the arming stems 37 and 51 release simultaneously the spring pressed rotor 80 and the firing pin 66 supported by the creep spring 67. Releasing the rotor allows the detonator 86 to move into alignment with the explosive charges 70 and 79 and lock in this position. The fuze body is then armed.

On impact, inertia of the firing pin 66 overcomes the resistance of the creep spring 67 to fire the primer in the cartridge type delay element 70, which provides delays of from zero to a .25 second delay. The delay element 70 sets the relay charge therein, which in turn functions the detonator 86 in the rotor 80. The detonator initiates the tetryl lead 79 which detonates a booster charge which in turn detonates the main bursting charge of the bomb.

We claim:

1. In an air travel delay arming fuze the combination comprising an arming vane assembly normal to and spaced from a fuze body assembly, a flexible shaft driven by said vane assembly, said fuze body assembly including a reduction gear train driven by said flexible shaft, a tubular gear lock housing rotated by said gear train, a two piece partly threaded arming stem slidably fitting within said tubular gear lock housing and extending therethrough, a threaded bore within said fuze body aligned axially with said tubular gear lock housing and threadingly receiving said stem along a portion of its length at spaced intervals thereon, said stem normally rotatably driven by said gear lock housing for axial movement relative to said fuze body, resetting means to disengage said stem from said gear lock housing for manual rotation of said stem relative to said gear lock housing, a threaded firing pin assembly and a detonator containing rotor held in safe position by said stem and simultaneously released by said stem to arm said fuze upon rotation of said stem a predetermined number of turns determined by said resetting means, a cartridge type delay element positioned within said fuze body in alignment with said firing pin and said rotor detonator in armed position thereof, there being latch means to lock said cartridge in said position, said latch means preventing seating of said fuze body in a bomb cavity until said delay element is placed in said fuze body and properly aligned relative to said firing pin and rotor detonator, said rotor detonator being of generally triangular shape and pivoted about one extremity thereof, spring means urging said rotor into armed position, means to lock said rotor in armed position and safety stop means for said stem constructed and arranged to prevent manual rotation of said stem to within a predetermined number of turns of armed position thereof.

2. In a fuze body assembly as stated in claim 1, said resetting means comprising an elongated longitudinal keyway formed in the upper portion of said arming stem, a cam pivotally mounted in said keyway, said cam having a generally wedge like configuration, a cam plunger longitudinally reciprocal within said keyway, a gear lock de-

tent normally urged into said keyway, said plunger constructed and arranged to pivot said cam into engagement with said detent to displace said detent from said slot thereby disconnecting said stem and the gear lock housing to allow manual rotation of said stem with respect to said gear lock housing for a predetermined number of turns only.

3. A fuze body assembly as stated in claim 1 in which said latch means comprises a peripheral groove in said cartridge type delay element, a transverse cylindrical bore formed in said fuze body housing normal to said cartridge and in alignment with the periphery of said groove when said cartridge is properly placed in said housing, a spring loaded piston slidable in said bore, said piston having an axial rod projecting a predetermined distance from both ends of said piston and of such length as to prevent seating of said fuze body assembly into the bomb cavity therefore unless said delay element is placed within said fuze body in proper position.

4. A fuze body assembly as stated in claim 1 in which said safety means comprises a resilient member secured to said arming stem, an offset bore in said tubular gear lock housing in juxtaposition with said stem, said member abutting the wall of said offset preventing rotation of said stem by said manual means to within a predetermined number of turns of armed position of said stem.

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